

REMARKS

Applicant respectfully requests reconsideration of the present application in view of the foregoing amendments and in view of the reasons that follow.

Claims 1 and 5 are currently being amended.

New claims 11 and 12 are being added. New claims 11 and 12 correspond to claims 1 and 5, respectively, prior to the present amendment.

This amendment changes and adds claims in this application. A detailed listing of all claims that are, or were, in the application, irrespective of whether the claim(s) remain under examination in the application, is presented, with an appropriate defined status identifier.

After amending the claims as set forth above, claims 1-12 remain pending in this application.

Rejection under 35 U.S.C. § 102

Claims 1-10 stand rejected under 35 U.S.C. 102(b) as being anticipated by U.S. Patent No. 5,546,179 to Cheng (hereafter “Cheng”). Applicant respectfully traverses this rejection for at least the following reasons.

Independent claim 1 is directed to a wafer edge exposure apparatus for exposing an edge of a semiconductor wafer. The apparatus includes an optical section for irradiating exposure light toward the edge of the semiconductor wafer, the semiconductor wafer having a resist thereon, and a sensor for detecting the height of the edge. On a basis of a value detected by the sensor, a focus position control mechanism controls the focal position of exposure light originating from the optical section. Thus, in the present invention as recited in claim 1, the sensor detects the height of the edge of the semiconductor wafer, and based on a value detected, the focal position of exposure light is controlled. The apparatus of claim 1 may solve problems associated with exposing the edge of resist films on a substrate, for example when the substrate has layers formed thereon (see present specification, page 4, lines 14-22). Thus, one advantage of the present invention of claim 1 is provided in applications

where the layers formed on the substrate have some topography that affects the exposure. Cheng does not disclose an apparatus including an optical section for irradiating exposure light toward the edge of the semiconductor wafer, the semiconductor wafer having a resist thereon.

Cheng discloses an apparatus for mapping the edge and other characteristics of a workpiece (title). The Cheng apparatus includes a sensor device 24 (of sensor assembly 14) including an emitter 40 and detector 42, where the emitter projects a beam of electromagnetic energy, such as visible or infrared light, towards the surface of a wafer 22 (col. 5, lines 58-63). The beam Bi is incident on the wafer surface and reflected from the surface back to the detector 42 (col. 5, lines 63-66). The probe assembly maps the edge and height of the wafer (col. 6, lines 58-61), and Figure 4 illustrates moving a sensor to measure intensity levels and moving the sensor to a focal distance.

While Cheng discloses measuring the intensity of electromagnetic radiation reflected from a wafer, and moving a sensor to a focal distance, Cheng does not disclose or suggest an optical section for irradiating exposure light toward the edge of the semiconductor wafer, the semiconductor wafer having a resist thereon. The electromagnetic energy from the emitter 40 of Cheng is for the purpose of providing radiation to be reflected from a wafer so that the intensity of the reflected radiation can be determined. The emitter 40 of Cheng does not disclose irradiating exposure light as recited in claim 1, toward an edge of a wafer having resist thereon. Nowhere does Cheng disclose that the structure of the emitter 40 is such so as to provide electromagnetic energy sufficient to expose resist. The electromagnetic energy from the emitter 40 is not for the purpose of exposing resist, i.e., it is not exposure light. Instead, Cheng is directed to an apparatus for mapping the surface of a wafer. Thus, Cheng fails to disclose the structure of claim 1 of the optical section for radiating exposure light as recited in claim 1.

Further, Cheng does not suggest the advantages of the invention of claim 1, where the apparatus may solve problems associated with exposing the edge of resist films on a substrate, for example when the substrate has layers formed thereon. As discussed above Cheng is not concerned with directing exposure light to a wafer so that resist may be exposed.

Independent claim 5 is directed to a wafer edge exposure method including detecting the height of an edge of a semiconductor wafer, the semiconductor wafer having a resist thereon, and controlling the focusing position of exposure light radiated toward the edge, on the basis of the height of the edge. Thus, for at least the same reasons as claim 1, claim 5 is also patentable over Cheng.

The dependent claims ultimately depend from either claim 1 or claim 5, and are patentable for at least the same reasons, as well as for further patentable features recited therein. For example, claims 9 and 10, respectively recite “radiating exposure light irradiates only an annular portion of the edge” and “wherein only an annular portion of the edge is irradiated in the exposure step.” These features are not suggested in Cheng.

New claims 11 and 12

New claims 11 and 12 correspond to claims 1 and 5, respectively, prior to the present amendment. New claims 11 and 12 are likewise patentable over Cheng.

Both claims 11 and 12 recite that the focal position of exposure light is controlled on the basis of the height of the edge detected by the sensor. In the Cheng apparatus adjustment of the focal position of the exposure light is completed before the sensor is moved to the edge portion of the wafer. As shown in Figure 3, in the Cheng procedure, the focal position adjustment is performed first (see step 80), and then the optical sensor is moved toward the wafer edge only after the focal adjustment (see step 82). Thus, Cheng fails to suggest that the focal position of exposure light is controlled on the basis of the height of the edge detected by the sensor, and both claims 11 and 12 (as well as claims 1 and 5, which include all the limitations of claims 11 and 12, respectively) are patentable over Cheng.

Applicant believes that the present application is now in condition for allowance. Favorable reconsideration of the application as amended is respectfully requested.

The Examiner is invited to contact the undersigned by telephone if it is felt that a telephone interview would advance the prosecution of the present application.

The Commissioner is hereby authorized to charge any additional fees which may be required regarding this application under 37 C.F.R. §§ 1.16-1.17, or credit any overpayment, to Deposit Account No. 19-0741. Should no proper payment be enclosed herewith, as by a check being in the wrong amount, unsigned, post-dated, otherwise improper or informal or even entirely missing, the Commissioner is authorized to charge the unpaid amount to Deposit Account No. 19-0741. If any extensions of time are needed for timely acceptance of papers submitted herewith, Applicant hereby petitions for such extension under 37 C.F.R. §1.136 and authorizes payment of any such extensions fees to Deposit Account No. 19-0741.

Respectfully submitted,

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